MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2019/2020

PSM0325 – INTRODUCTION TO PROBABILITY AND STATISTICS

(Foundation in Information Technology / Life Sciences)

25 OCTOBER 2019
9.00 am – 11.00 am
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **THREE** pages excluding the cover page and the Appendix.
2. Answer **ALL FIVE** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided. All necessary working steps **MUST** be shown.
4. **Statistical table** is provided.

Instruction: Answer all **FIVE** questions.

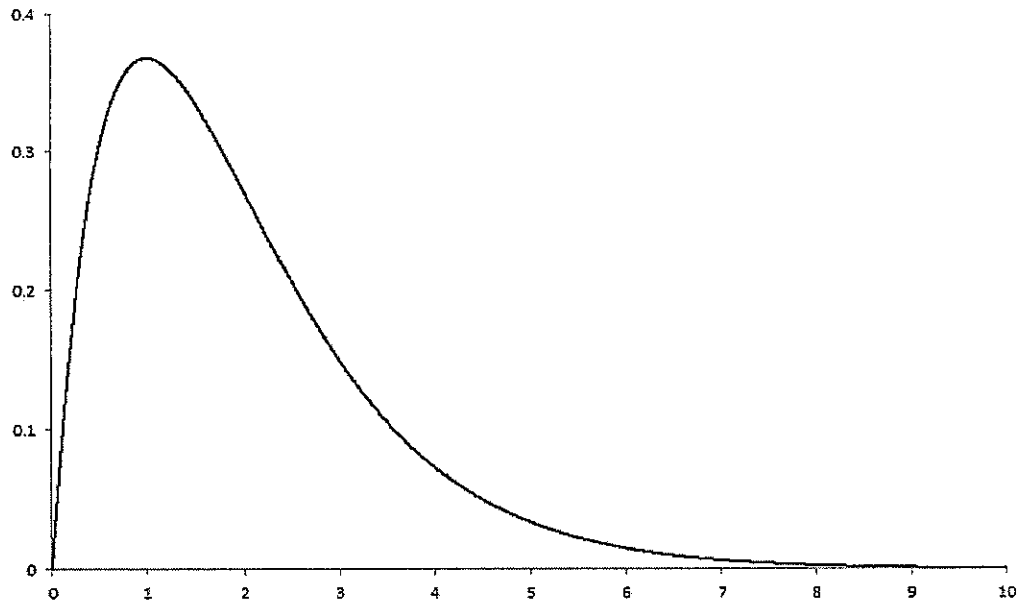
Question 1 (10 marks)

a. Given a frequency distribution,

Class	Frequency
14 – 18	3
19 – 23	5
24 – 28	8
29 – 33	8
34 – 38	14
39 – 43	12

find the values for the median and the mode. (7 marks)

b. Given the graph of a probability distribution. Copy the graph and draw three straight lines from the curve to the x-axis for the location of the mode, median and mean. Label the lines. (3 marks)



Continued...

Question 2 (10 marks)

a. Let X be the random variable that denotes the time taken (in hours) for a student to complete an assignment. The probability density function is:

$$f(x)=\begin{cases} kx & , \quad 0 \le x < 5 \\ \frac{2}{5}-kx & , \quad 5 \le x < 10 \\ 0 & , \quad elsewhere \end{cases}$$

where k is a constant.

i. Show that $k=\frac{1}{25}$ (3 marks)

ii. What is the probability that the time taken to complete an assignment is at least 6 hours? (3 marks)

b. A box consists of three red marbles, three blue marbles and two white marbles. A kid chooses three marbles at random from the box. Find the probability for the number of:

i. three white marbles are selected. (1 mark)

ii. one for each color. (3 marks)

Question 3 (10 marks)

a. The monthly expenses of the managers in 3M Marketing company are normally distributed with a mean of RM7500 and a standard deviation of RM1500. Find the probability that the mean monthly expenses for a random sample of 30 managers in the company is:

i. less than RM6800. (2 marks)

ii. within RM550 of the population mean. (3 marks)

b. The probability that a family will subscribe for the TIME magazine is 0.25. If 12 families are selected at random,

i. find the probability that at least 8 families will subscribe for the magazine. (3 marks)

ii. find the mean and the standard deviation for subscribing the magazine. (2 marks)

Continued...

Question 4 (10 marks)

a. Consider the population of 5 numbers:

45 48 50 37 45

i. List all the possible samples of size three (without replacement) that can be selected from the data and calculate the mean for each sample. (4 marks)

ii. Construct the sampling distribution of $\bar{x}$. (2 marks)

b. A random sample of 30 households was selected as part of a study on petrol usage, and the number of liters of petrol was recorded for each household in the sample for the first quarter of 2015. The average usage was found to be 375 liters. Given the standard deviation of the usage for the first quarter from the previous year was 81 liters.

i. Calculate a 99% confidence interval for the mean usage in the first quarter of 2015. (3 marks)

ii. If the number of sample is increased to 50, what will be the effect on the confidence interval. (1 mark)

Question 5 (10 marks)

a. Write the null and alternative hypothesis for the following and determine if it is a two-tailed, a left-tailed or a right-tailed test.

i. A private college claims that the students, on the average, take at most four years to graduate from college. (2 marks)

ii. A private hospital spoke person claims that the average daily room for the patient is at RM 85.00. (2 marks)

b. A manufacturer claims that the mean battery life of all hand phones that the company produces is at least 17 hours. An independent consumer-protection agency wishes to test the credibility of the manufacturer's claim and measures the battery life of a random **sample** of 30 hand phones from a recently produced batch is 15 hours. Given the standard deviation is 3 hours.

i. Set up the hypothesis test, H_0 and H_1. (2 marks)

ii. What can the independent consumer-protection agency concludes at a 2% significance level? (4 marks)

End of Paper

APPENDIX

Formulae:

1.

	Ungrouped data	Grouped data
Mean:	$\bar{x}=\frac{\sum x}{n}$ $\mu=\frac{\sum x}{N}$	$\bar{x}=\frac{\sum mf}{n}$ $\mu=\frac{\sum mf}{N}$
Variance:	$s^2=\frac{\sum x^2-\frac{\left(\sum x\right)^2}{n}}{n-1}$ $\sigma^2=\frac{\sum x^2-\frac{\left(\sum x\right)^2}{N}}{N}$	$s^2=\frac{\sum m^2 f-\frac{\left(\sum mf\right)^2}{n}}{n-1}$ $\sigma^2=\frac{\sum m^2 f-\frac{\left(\sum mf\right)^2}{N}}{N}$
Median:		$L+\left[\frac{\left[\frac{\sum f+1}{2}\right]-F_L}{f_m}\right]w$
Mode:		$L+\left[\frac{f_m-f_B}{(f_m-f_B)+(f_m-f_A)}\right]w$

2.

	Mean	Variance
Discrete Random Variable X	$\mu=E(X)$ $=\sum xP(x)$	$Var(X)=E(X^2)-[E(X)]^2$ **where** $E(X^2)=\sum x^2P(x)$
Continuous Random Variable X	$\mu=E(X)$ $=\int_{-\infty}^{\infty}xf(x)dx$	$Var(X)=E(X^2)-[E(X)]^2$ **where** $E(X^2)=\int_{-\infty}^{\infty}x^2f(x)dx$

3.

	Formula	Mean	Standard Deviation
Binomial Probability	$P(x)=\binom{n}{x}p^xq^{n-x}$	$\mu=np$	$\sigma=\sqrt{npq}$
Poisson Probability	$P(x)=\frac{e^{-\lambda}\lambda^x}{x!}$	$\mu=\lambda$	$\sigma=\sqrt{\lambda}$

4. The z value for a value of x: $z = \dfrac{x - \mu}{\sigma}$

5. The z value for a value of $\bar{x}$: $z = \dfrac{\bar{x} - \mu_{\bar{x}}}{\sigma_{\bar{x}}}$

where $\mu_{\bar{x}} = \mu$ and $\sigma_{\bar{x}} = \dfrac{\sigma}{\sqrt{n}}$

6. Sampling error = $\bar{x} - \mu$
Non-sampling error = incorrect $\bar{x}$ − correct $\bar{x}$

7. Point estimate of $\mu = \bar{x}$

Margin of error = $\pm 1.96\sigma_{\bar{x}} = \pm 1.96\dfrac{\sigma}{\sqrt{n}}$ or $= \pm 1.96 s_{\bar{x}} = \pm 1.96\dfrac{s}{\sqrt{n}}$

8. The $(1-\alpha)100\%$ confidence interval for μ is

$\bar{x} \pm z\sigma_{\bar{x}}$ is known

$\bar{x} \pm z s_{\bar{x}}$ if σ is not known

where $\sigma_{\bar{x}} = \dfrac{\sigma}{\sqrt{n}}$ & $s_{\bar{x}} = \dfrac{s}{\sqrt{n}}$